

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: **John A. McFarland, et al.**

Application No.: **10/817,563**

Examiner: **Tuan N. Quach**

Filed: **April 2, 2004**

Group Art Unit: **2826**

For: **HIGHLY SELECTIVE SILICON OXIDE ETCHING COMPOSITIONS**

Attorney Docket No.: **H0004908 (P25,370-A USA)**

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**Reply Pursuant to 37 C.F.R. §1.111**

Sir:

The following remarks are submitted in response to the Office Action mailed July 31, 2006. Reconsideration by the Examiner and allowance of the pending claims is respectfully requested.

In the Official Action, Claims 1 – 4 were rejected under 35 U.S.C. §103(a) as being unpatentable over Dao et al., U.S. Patent No. 5,824,601 in view of Ohmi et al. U.S. Patent No. 5,277,835. Dao et al. was cited as teaching a silicon oxide etching solution consisting of a bifluoride source compound in an organic solvent with 9% water and 8% HF, in view of which the Examiner considered the presently recited water and HF ranges to be an obvious optimization. Ohmi et al. was cited as also teaching HF levels that suggested the presently recited ranges. This rejection is respectfully traversed for the reasons set forth hereinafter.

Dao et al. discloses etching solutions containing only HF and solvent, with no bifluoride source compound. Dao et al. instead at column 1, lines 29 – 37 criticizes solutions

containing a bifluoride source compound such as ammonium fluoride as lacking etch selectivity:

One prior etching solution is a so-called buffered oxide etch (BOE) solution containing hydrogen fluoride buffered by ammonium fluoride. However, the BOE solution exhibits poor etch selectivity in that this solution severely attacks or etches exposed metal, polysilicon, and/or nitride surfaces during the sacrificial oxide etch. In particular, aluminum metallization is often almost completely eroded before the sacrificial oxide is completely removed.

The present invention solves the etch selectivity problem of solutions containing bifluoride source compounds such as ammonium fluoride by the addition of water and hydrogen fluoride within the claimed ranges. (See present specification at page 3, lines 1-13.) Dao et al. does not disclose the use of a bifluoride source compound in combination with hydrogen fluoride and instead teaches against the inclusion of bifluoride source compounds. Dao et al. also teaches that the amount of water should be reduced and preferably eliminated.

Thus, Dao et al. contains no motivation to modify the solutions disclosed therein to prepare the presently claimed solutions by adding a bifluoride source compound. According to Dao et al., doing so destroys etch selectivity. The improvement in etch selectivity obtained by the presently-claimed solutions is therefore completely unexpected from the teachings of Dao et al. Because the presently claimed solutions and the advantages obtained therefrom are neither taught nor suggested by Dao et al., Claims 1 - 4 patently define thereover under 35 U.S.C. §103(a).

The Examiner cites Ohmi et al. as confirming the teachings of Dao et al. considered by the Examiner to render the presently claimed hydrogen fluoride range obvious. But Ohmi et al. discloses aqueous solutions of HF and ammonium fluoride. Because Dao et al. teach against the use of ammonium fluoride and the amount of water employed by Ohmi et al., there is no motivation to combine these publications to arrive at the presently claimed invention.

At best, Dao et al. suggests the removal of ammonium fluoride and the elimination of water to improve the etch selectivity of the Ohmi et al. compositions. The teachings of Dao

et al. and Ohmi et al., viewed alone or in combination, therefore fail to teach or suggest a solution containing water and hydrogen fluoride in the presently claimed ranges that also contains a bifluoride source compound, particularly because the improvement in etch selectivity is completely unexpected from the teachings of these two cited publications.

Accordingly, because the presently claimed solutions and advantages obtained therefrom are neither taught nor suggested by the cited combination of Dao et al. and Ohmi et al., Claims 1 – 4 patentably define thereover under 35 U.S.C. §103(a). Reconsideration by the Examiner and withdrawal of this rejection is therefore respectfully requested.

Finally, Claims 4 – 7 were rejected under 35 U.S.C. §103(a) as being obvious in view of Dao et al. and Ohmi et al. as applied to Claims 1 – 4, and further in view of Yates, U.S. Publication No. 2004/0250835 and Jagannathan et al., US 6,200,891. The Examiner acknowledges that Dao et al. and Ohmi et al. fail to disclose the alternate fluoride source compounds of Claim 4 and the organic nitrogen compounds of Claim 7, but cites Yates and Jagannathan et al. as disclosing these. This rejection is respectfully traversed for the reasons set forth hereinafter.

It is not surprising the bifluoride source compounds of Claim 4 are not disclosed by Dao et al., because Dao et al. does not use such compounds for a perceived negative impact on etch selectivity. While Yates discloses the use of hydrogen fluoride and bifluoride source compounds alone or in combination, the Yates solutions contain significant amounts of water. Because bifluoride source compounds and significant amounts of water are used, Yates cannot properly be combined with Dao et al. Further, Yates contains no teaching of compositions containing the presently claimed ranges of hydrogen fluoride and water in combination with a bifluoride source compound, let alone the advantages obtained therefrom.

Jaganathan et al. similarly discloses anhydrous solutions of a fluoride-containing compound in a solvent. HF and bifluoride source compounds are listed as suitable fluoride-

containing compounds, again alone or in combination. But there is no teaching of using bifluoride source compounds with 0.5 to 3% by solution weight of HF and 1 to 5% by solution weight of water, or the advantages obtained therefrom. Instead, Jaganthan et al. teach against the use of water in such solutions. With Dao et al. teaching against the use of bifluoride source compounds, the advantages of the presently claimed invention are completely unexpected from the disclosure of the cited prior art, viewed alone or in combination.

Accordingly, because the presently claimed solutions and the advantages obtained therefrom are neither taught nor suggested by the cited combination of prior art, Claims 4 – 7 patentably define thereover under 35 U.S.C. §103(a). Reconsideration by the Examiner and withdrawal of this rejection is therefore respectfully requested.

It is believed the claims in this application are in condition for allowance. Reconsideration is respectfully requested. The Examiner is requested to telephone the undersigned if there are any remaining issues to be resolved. If there are any additional charges in connection with this Reply, the Examiner is authorized to charge Applicants' Deposit Account No. 19-5425.

Respectfully submitted,

Dated: October 25, 2006

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